[0130] In another embodiment of the present invention, there is provided a computing interactive apparatus including:

a) a touch-sensitive screen, that computes X-Y positions of the user finger touching the screen allowing to interact with a graphical user interface and graphical images presented on the screen;

b) tactile actuators embedded into the touch screen, so that the haptic feedback can be provided when the user is touching the screen surface with their fingers;

c) a pressure sensing device embedded in to the touch screen, that measures pressure that user applies to the screen when touching it;

d) computing and control components to produce an arbitrary haptic sensations on the touch screen;

c) graphical user interface (GUI) visual components and underlying control software;

d) control software techniques that correlate i) user input, captured by touch screen, (i.e. where the user touches the screen, which GUI components are actuated), ii) pressure applied to the screen by the user finger and (iii) the logical state of the interactive objects with dynamic tactile feedback presented to the user.

[0131] According to the foregoing embodiments of the present invention, there is provided a user interface method and apparatus including a display device and a touch panel device, which allow a user to have interaction operations similar to interaction with real physical buttons.

[0132] According to the foregoing embodiments of the present invention, there is provided a user interface method and/or apparatus which enable a user to feel graphical user interface objects displayed on a touch-screen of display, before choosing the one that the user wants to interact with.

[0133] According to the foregoing embodiments of the present invention, there is provided a user interface method and/or apparatus which allow for more natural interaction as well as easier blind interaction.

[0134] While the present invention has been described with reference to illustrative embodiments, this description is not intended to be construed in a limiting sense. Various modifications of the illustrative embodiments, as well as other embodiments of the invention, which are apparent to persons skilled in the art to which the invention pertains are deemed to lie within the scope of the invention.

1. An apparatus including a display section with a touch screen, the touch screen being adapted to display at least one graphical user interface object and detect a touch position on the touch screen, the touch position being inputted with a user's finger or a pointing device, the apparatus comprising:

a haptic feedback generating unit attached to the touch screen and adapted to generating haptic feedback;

a pressure sensing unit attached to the touch screen and adapted to detect pressure applied to the touch screen; and

a controller section adapted to control and drive the display section; wherein

the graphical user interface object displayed on the touch screen has a plurality of logical states;

the controller section determines a current logical state of the graphical user interface object using a history of detected touch positions and a history of detected pressure values;

the controller section further determines a form of the haptic feedback to be generated depending on (i) the detected touch position, (ii) the detected pressure value and (iii) the determined current logical state of the graphical user interface object.

2. The apparatus according to claim **1**, wherein:

the controller section controls the haptic feedback generating unit to generate different tactile feedback for different logical states of the graphical user interface object.

3. The apparatus according to claim **2**, wherein:

the logical states of the graphical user interface object include at least a selected state and an actuated state;

the controller section determines that the graphical user interface object is in the actuated state if a pressing event is recognized; and

the controller section recognizes the pressing event using a history of the detected pressure value.

4. The apparatus according to claim **2**, wherein:

the logical states of the graphical user interface object include at least a selected state and an actuated state; and

the controller section determines that the graphical user interface object is in the actuated state if: (i) the touch position is inside of the graphical user interface object; and (ii) the detected pressure is more than a preset actuation threshold value.

5. The apparatus according to claim **2**, wherein:

the logical states of the graphical user interface object include at least a selected state and an actuated state; and

the controller section determines that the graphical user interface object is in the actuated state if: (i) the touch position is inside of the graphical user interface object; and (ii) a history of the detected pressure satisfies a preset actuation condition.

6. The apparatus according to claim **1**, wherein:

the haptic feedback generation unit includes a single or plurality of piezoelectric elements; and

at least one of the piezoelectric elements is used for generating the haptic feedback and detecting the pressure applied by the user.

7. The apparatus according to claim **1**, wherein:

the controller section further controls either a frequency of the haptic feedback, an amplitude of the haptic feedback or both amplitude and frequency of the haptic feedback simultaneously.

8. The apparatus according to claim **1**, wherein:

the controller section controls the haptic feedback generating unit to generate a continuous haptic feedback as long as the touch position is inside of the graphical user interface object; and

the controller section changes the continuous tactile feedback in response to a change of the pressure applied to the touch screen, the change of the continuous tactile feedback depending on the current logical state of the graphical user interface object.

9. The apparatus according to claim **1**, wherein:

the controller section controls the haptic feedback generating unit to generate a single burst of the haptic feedback when the touch position crosses over a hotspot predefined within the graphical user interface object.

10. The apparatus according to claim **1**, wherein:

the controller section controls the haptic feedback generating unit to generate a single burst of the tactile